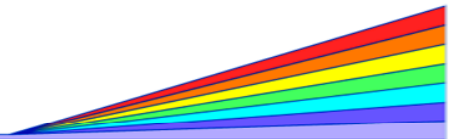


Insertion Devices for High Energy X-ray Research at the APS

Dean R. Haeffner

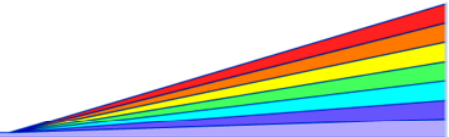
XFD
Advanced Photon Source
Argonne National Laboratory

December 5, 2002

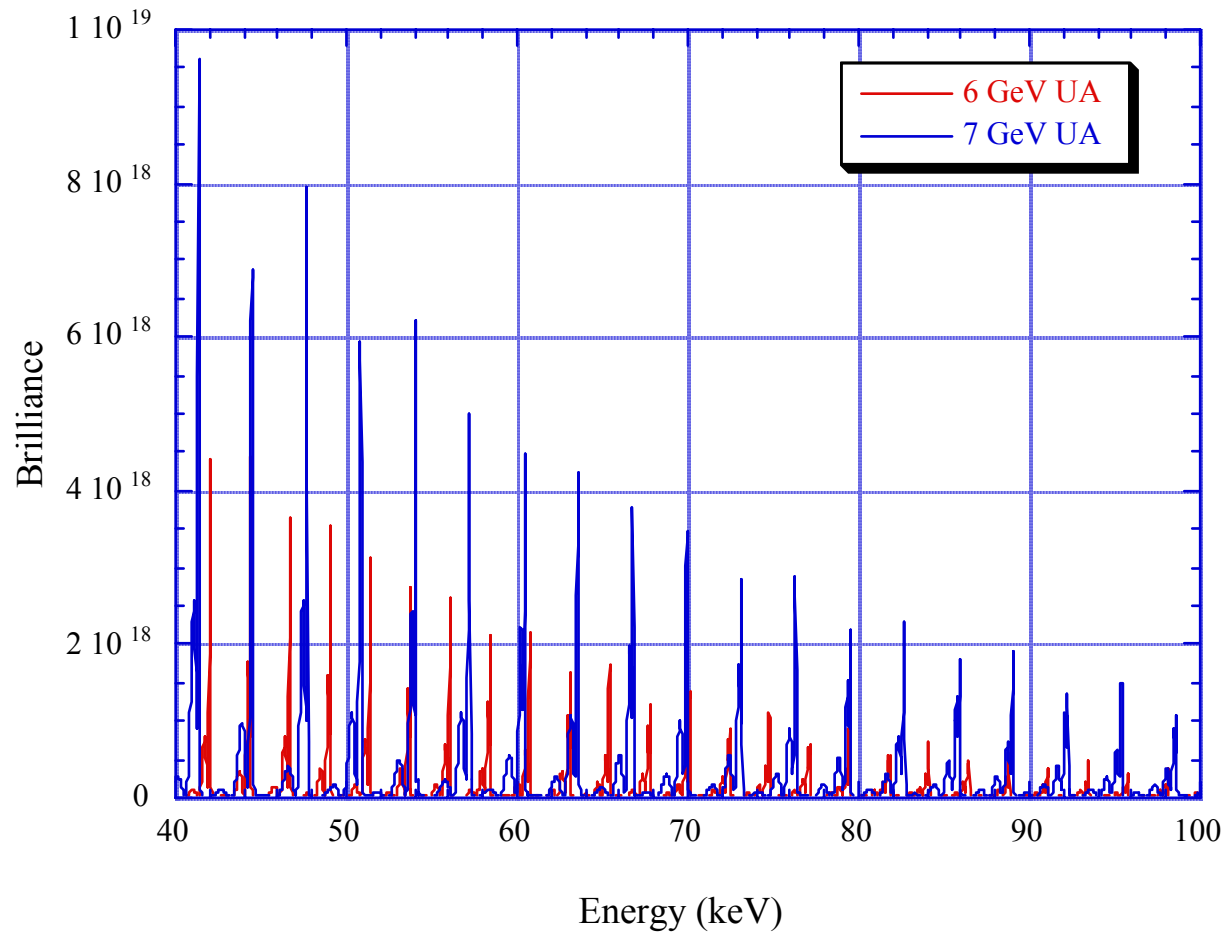


High Energy Programs at the APS

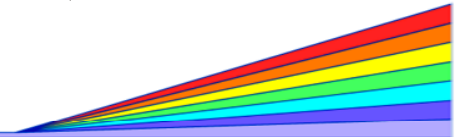
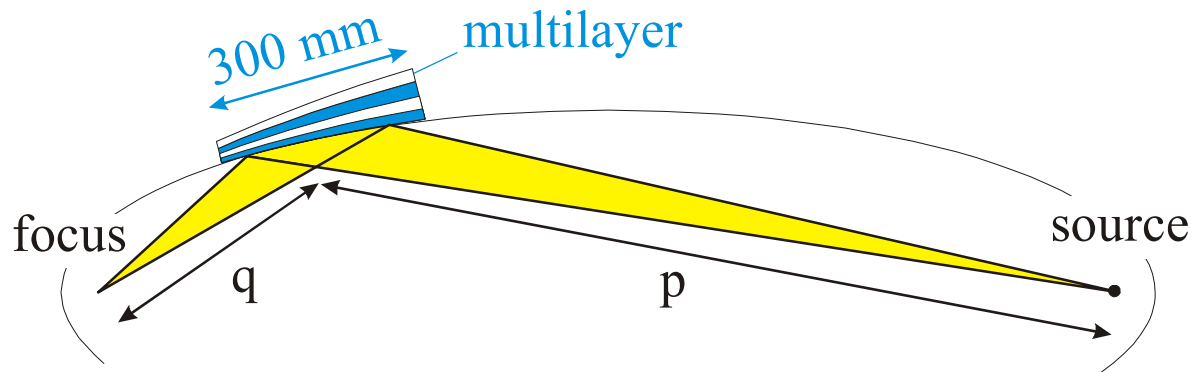
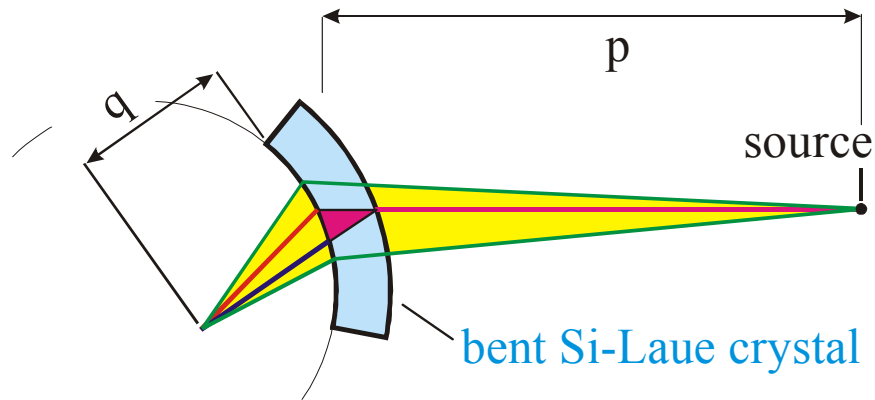
- SRI-CAT/XOR 1-ID
 - Undulator A
- BESSRC-CAT
 - Elliptical multipole wiggler
- mu-CAT
 - Dedicated side station, shared beamline with low-energy stations
- DND-CAT
 - Bending magnet, not optimized for high energies
- GSECARS-CAT



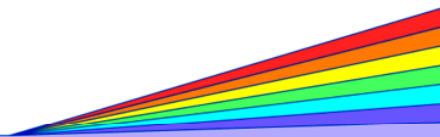
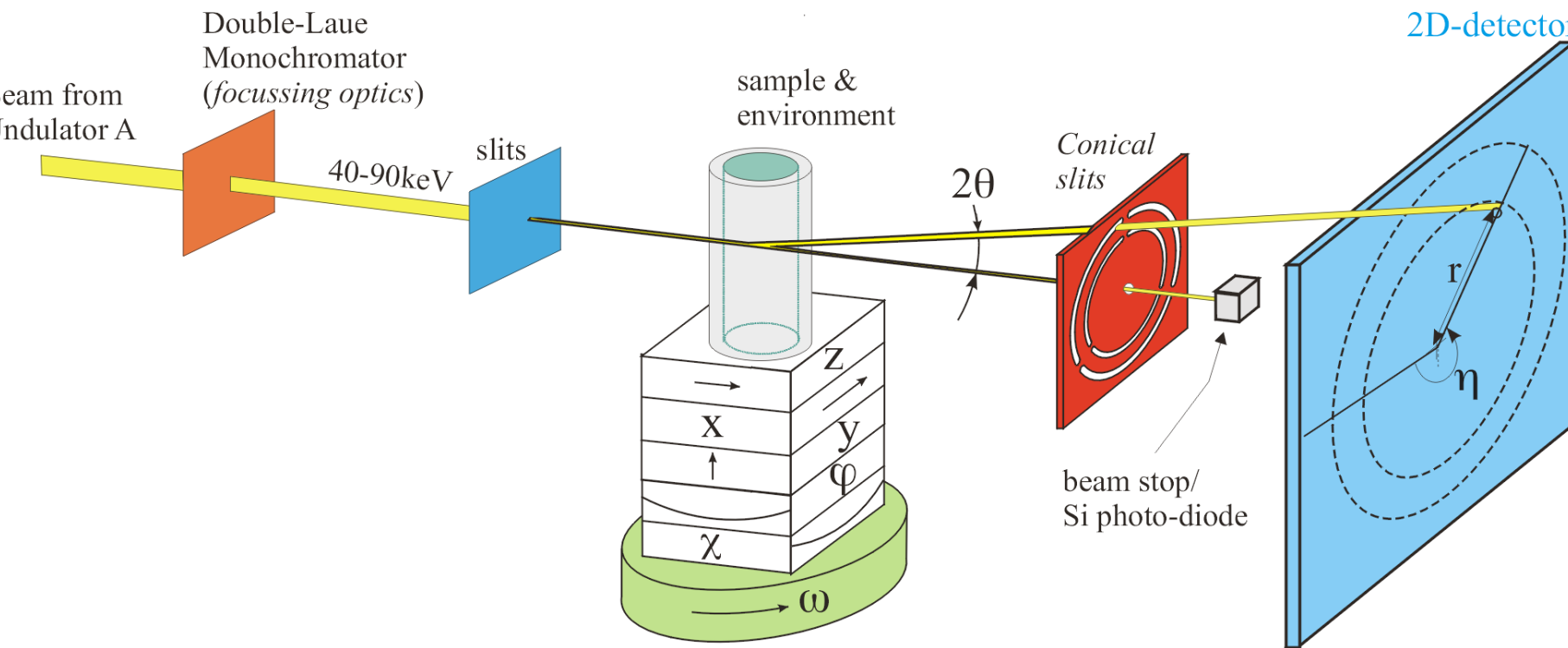
Undulator A at 6 & 7 GeV



High Energy Focusing

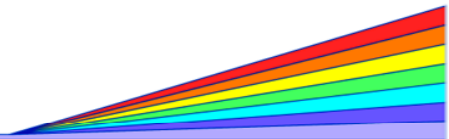


Experimental Setup



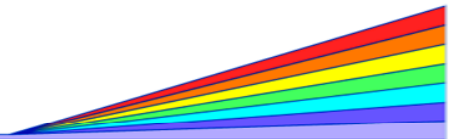
High Energy X-ray Perspective on Source Improvement

- Short period undulators
- Small gap ID chambers
- Horizontal source size
 - At high energy, source size, divergence dominated by storage ring contributions
 - For microfocusing, small β
 - For unfocused beam, large β



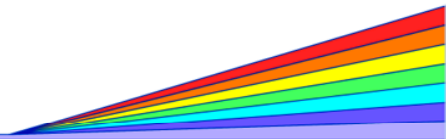
Undulator Design Factors

- Design for maximum brilliance
- Full spectral coverage above 35 keV
- The design will be based upon a minimum gap of 8.5 mm
- Permanent magnet devices
- Two devices may be used for spectral coverage
- All devices will be 2.5 m in length
- Use APS storage ring values from August of 2001

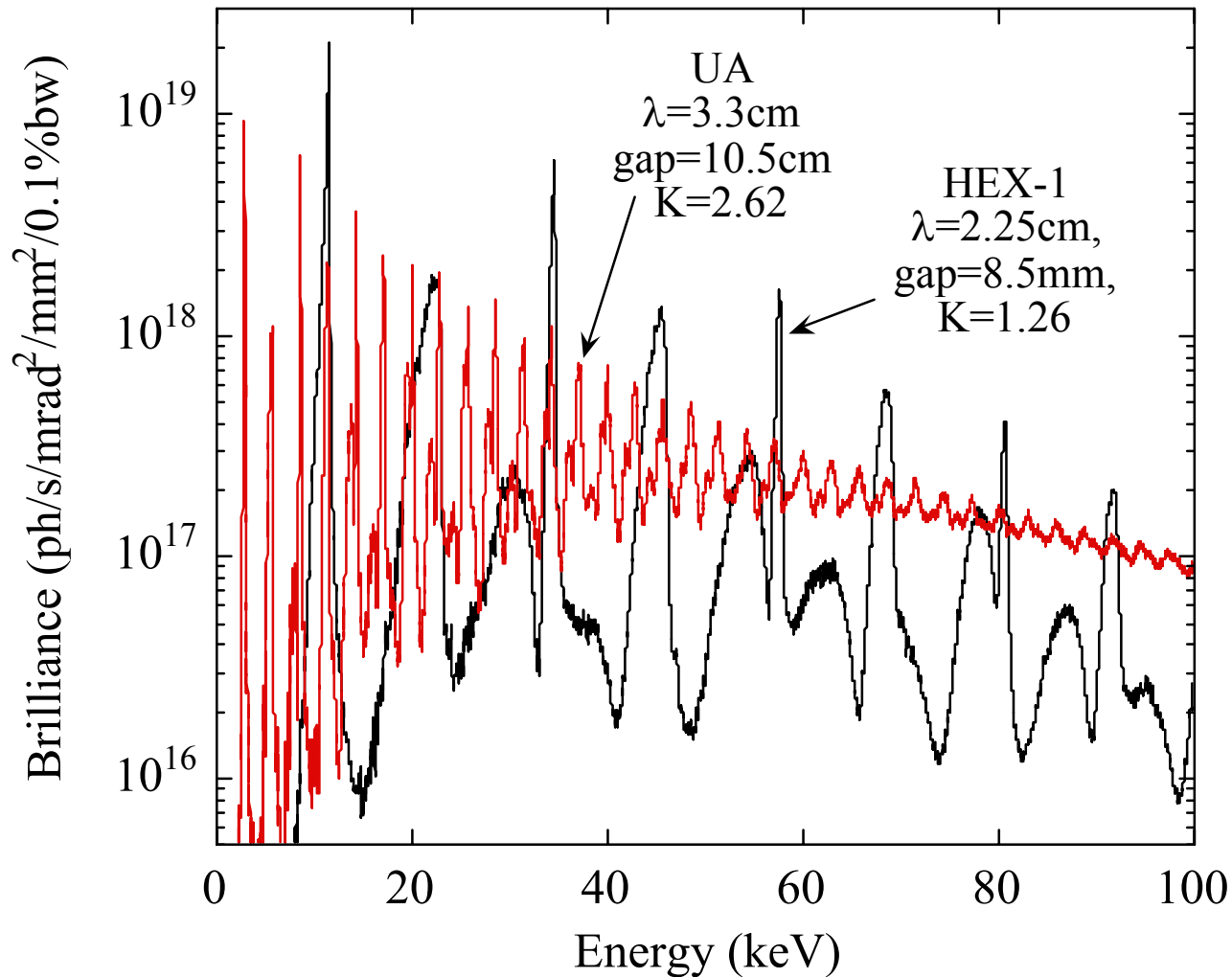


Undulator Parameters

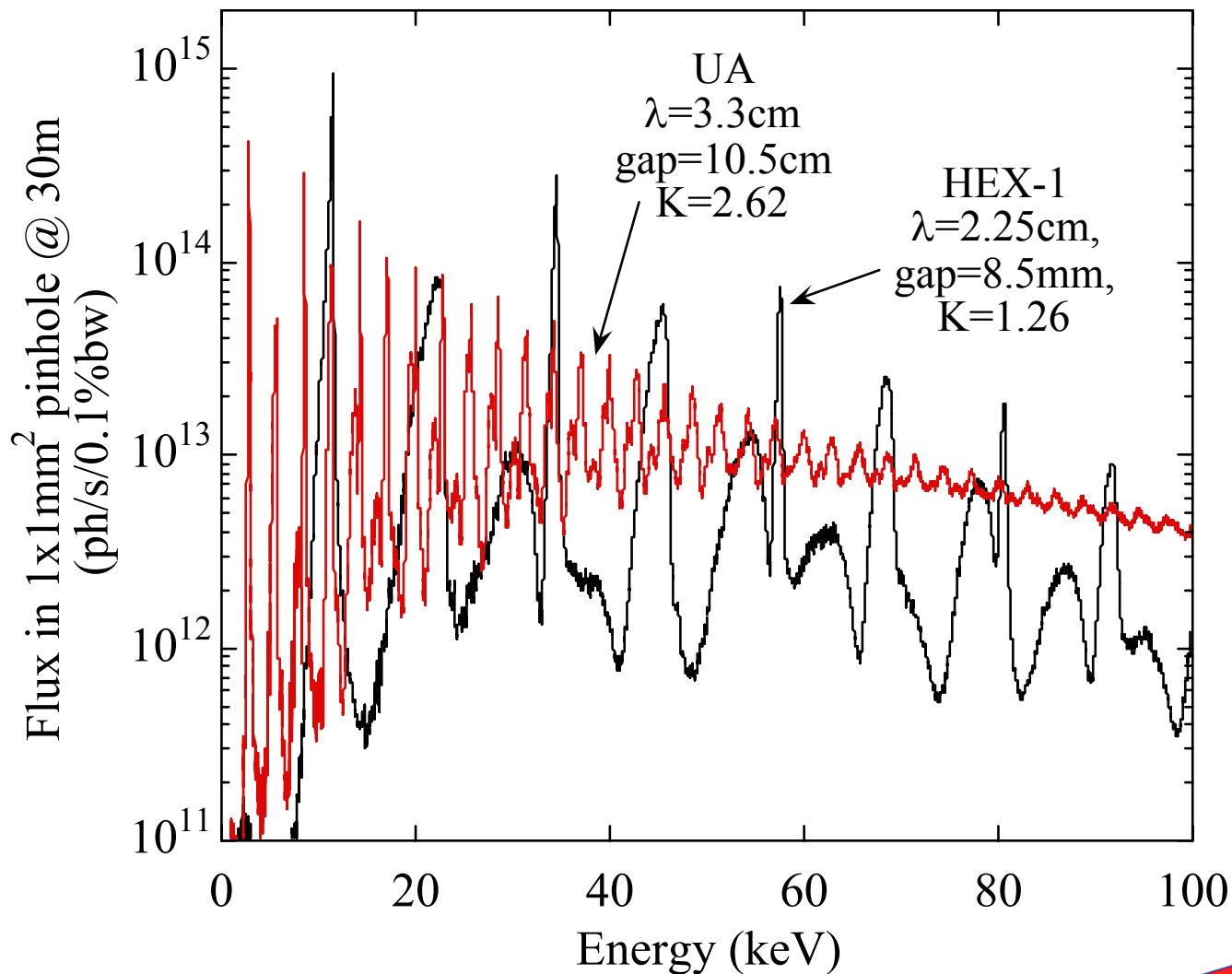
	UA	HEX-1	HEX-2
Period (cm)	3.3	2.25	2.05
Length (m)	2.5	2.5	2.5
Number of Periods	72	111	122
Minimum gap (mm)	10.5	8.5 (6.5)	8.5
B_{\max} (T)	0.85	0.6 (0.85)	0.5
K_{\max}	2.62	1.26 (1.8)	1.0
Total Integrated Power (kW)	5.4	2.8 (5.7)	2.1
Integrated Power in 1 x 1 mm ² @ 30 m (W)	160	168 (234)	155



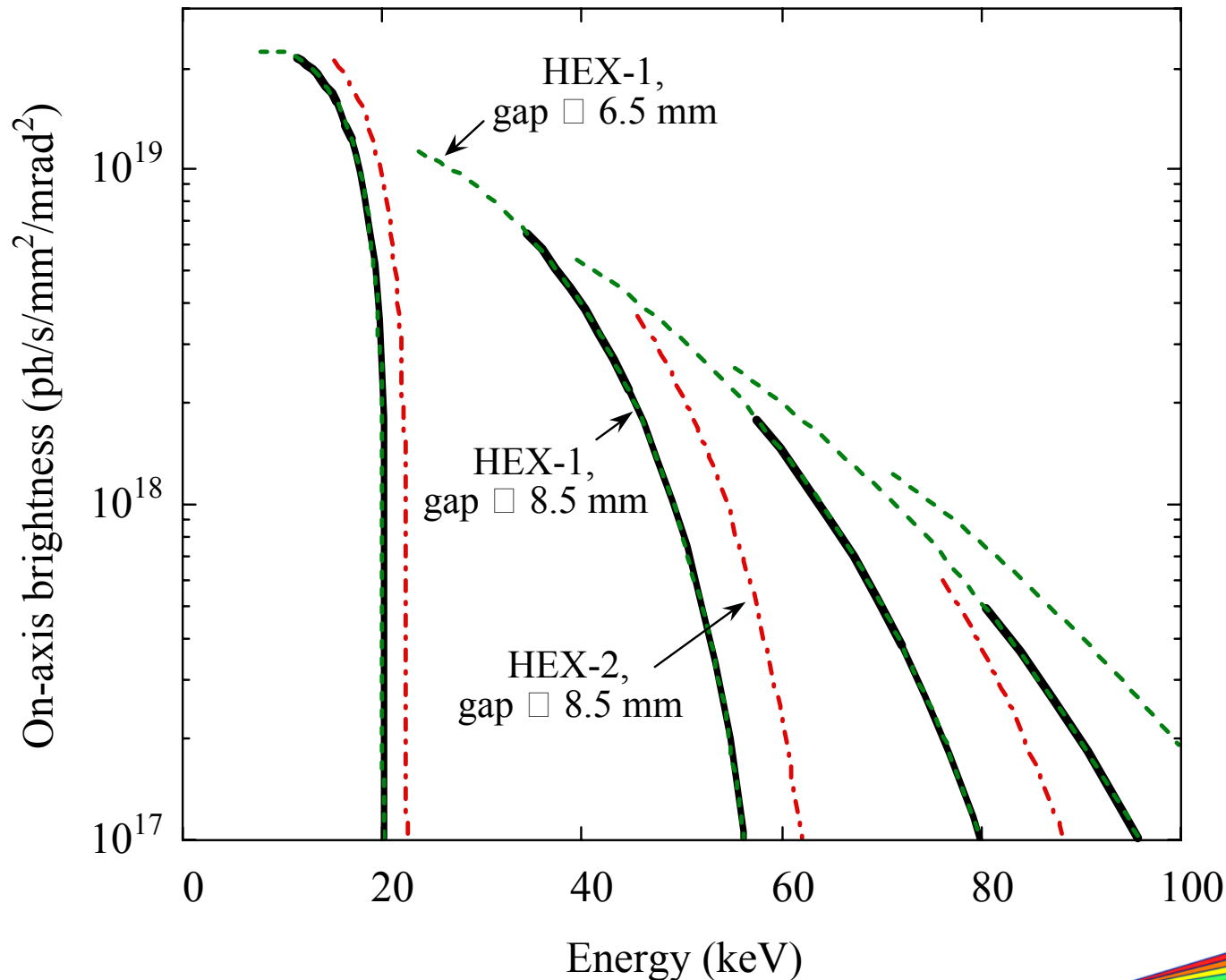
High Energy Undulator Brilliance



High Energy Undulator Flux



Undulator Tuning Curves



Conclusions

- Considerable gains in brilliance are available when two devices are used for spectral coverage.
- Power and power density is much less of a problem for short period devices.
- Gains of approximately a factor of 10 are available over Undulator A.
- Flux and brilliance criteria give similar results.
- Substantial gains would be available with a 6.5-mm vacuum chamber and likely APS storage ring upgrades.

